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UNDERGRADUATE MATHEMATICS CLUBS

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CLUB ACTIVITIES.

THE MATHEMATICS CLUB OF THE UNIVERSITY OF MAINE, Orono, Me.

Scientific organizations at the University of Maine have gradually tended to become more special in their nature. The Maine State College, and later University of Maine, Scientific Association was probably organized in the seventies and flourished until some time in the nineties. In a sense The Mathematics and Physics Club was a successor to this organization and lasted for several years before disintegration by reason of the fact that "many of the men formerly interested in it were engineers, and several engineering clubs and societies were formed which occupied the attention of such men. The activities of this club were in part transferred for a time to voluntary meetings of the members of the mathematics department with students in that department, and of the physics faculty with major students in physics." But in February, 1916, it was felt that there was sufficient interest to maintain a separate organization and the new club was founded.

Its object is "to promote interest in the study of mathematics" and its members "consist of all persons connected with the departments of mathematics and astronomy and of any other persons sufficiently interested in mathematics to make application for a membership and who shall be elected by written ballot by a majority of the members present at any regular meeting." Average attendance this year about 8 of the 18 members.

Officers, 1917–18: President, Edith E. De Beck '18; vice-president, Samuel Guptill '20; secretary, Mildred Bisbee '20. The program committee consists of Professor M. O. Tripp, chairman, and the officers.

The following meetings have been held in 1917–18:

November 7: Business, including election of officers to fill vacancies caused by war conditions.

November 14: "Duplication of the Cube" by Samuel Guptill '20.

December 5: "Comparison of the Different Methods Used in the Duplication of the Cube" by Maynard Jordan and Quentin Stauffer, instructors in mathematics.

December 19: "History of Trigonometry" by Edith Deering '21.

January 10: "Mathematics for Engineering Students" by Professor Tripp; "History and Teaching of Mathematics in the United States" by Mildred Bisbee '20.

THE MATHEMATICS CLUB OF NORTHWESTERN UNIVERSITY, Evanston, Ill.

This club was organized in January, 1916, with a membership of 30. Membership was restricted to: (1) Members of the faculty, and graduate students, in the departments of mathematics, physics, engineering and astronomy; (2) Seniors who are taking their major work in mathematics; (3) Students who have creditably completed 18 semester hours of work in the department of mathematics.

At a recent meeting, an amendment to the constitution was passed, extending membership to Juniors who are taking one or more courses as advanced as "C" in the department of mathematics. Representative courses of "C" grade are: higher algebra, solid analytic geometry, and advanced calculus.

Last year the Mathematics Club contained about 40 active members. At present (February 1) the active membership is about 20; but it is expected that the extension of membership privileges to Juniors will considerably increase the number.

Under the membership requirements the officers of the club are necessarily seniors or graduate students. Officers, 1917–18: President, Theodore Doll '17; vice-president, Franklin Mohr '18; secretary, Mae Campbell '18; treasurer, Helen Maloney '18; faculty adviser, Professor Robert E. Wilson. The program committee is composed of the faculty adviser, president, vice-president, and two members chosen by these three. The other two members are: Anastasia Zachariou '18 and Elizabeth Sheldon '18.

Meetings of the club are now held once in three weeks. Last year they were held once in two weeks. The lectures are about evenly divided between students and faculty. The programs for 1916 were as follows:

February 16: "The Construction of a Conic, given five Elements two of which are Imaginary" by Professor Thomas F. Holgate.
March 1: "What is Mathematics?" by Theodore Doll '17.
March 16: "Computing Machines" by Henry A. Babcock Gr., Fellow in physics.
March 29: "The History of π" by Minna Schick '16.
April 12: "The Method of Least Squares" by Harvey A. Anderson Gr.
April 26: "The Algebra of Al-Khowarizmi" by Ruby Lane '16; "The Hindu Arabic Numerals" by Harriet Knudsen '16.
May 10: "Descartes's Rule of Signs" by Professor David R. Curtiss.
May 24: "The Poincaré World" by Elizabeth Soderholm Gr.
October 12: "The Determination of Stellar Parallax" by Professor Philip Fox, director of Dearborn Observatory.
October 26: "Poincaré's Science and Hypothesis" by Dorothy Andrews '17.
November 9: "Arithmetical Stunts" by Leonard Janes '17.
November 23: "Euler" by Mabel Dinsmore '17; "Laplace" by Laura Hill '17.
December 7: "Railroad Curves" by Professor William H. Burger.

The following programs were given in 1917 and in the early part of 1918:

January 11: "Moritz's Memorabilia Mathematica" by Dorothy Waugh '17, Ruth Austin '17 and Robert Smyth Gr.
January 25: "Mathematical Journals" by Professor Curtiss.
February 15: "Galileo" by Henry Crew, professor of physics.
March 1: "Paper Folding" by Olga Podlesak '17.

March 15: "Circular Diagrams of Stress and Strain, and the Ellipse of Elasticity" by Hugh P. Bersie '17.
March 29: "Triangles and Squares" by Frank E. Wood, instructor in mathematics.
April 12: "Newton as Astronomer" by Luella Sayer Gr.; "Newton the Mathematician" by Helen Forbes '17; "Newton-The Leibnitz Controversy" by Ella Schneider '17; "Newton the Physicist" by William H. Grau, assistant in physics.
April 26: "History of Trigonometry" by Mary K. Voorhees '17; "Fourth Dimensional Geometry" by Frederick L. Kerr, Jr.
May 10: "Line Coordinates" by Professor Chester H. Yeaton.
May 24: "Some Generalizations of Rolle's Theorem" by Minna Schick, Jr.
November 15: "The real Roots of a Cubic Equation" by Professor Wilson.
December 5: "The Trigonometric Solution of the Cubic" by Anastasia Zachariou '18.
January 10: "The Problem of Two Bodies" by Franklin Mohr '18.
January 24: "The Mathematics of Field Artillery" by Professor E. J. Moulton.
February 14: "The Use of Complex Numbers in Electrical Theory" by William C. Bauer, professor of electrical engineering.

A service flag for the Mathematics Club would contain six stars. For all the information given above concerning the Club the editor is greatly indebted to President Doll who expects to be called to the colors before June.

THE MATHEMATICS CLUB OF THE UNIVERSITY OF OREGON, Eugene, Oregon.

This club was organized in October, 1916, "to promote a broad interest in the whole field of mathematics, especially in phases of it that are not dealt with in the regular courses; also to touch upon interesting and useful applications, the human element and the recreational." All students in the department of mathematics and allied departments are eligible for membership. There are 30 members; average attendence about 20.

Officers, 1917–18: President, Olga Soderstrom '18; vice-president, Ruth Westfall '18; secretary, Helen Wells '18; treasurer, Kenneth Moores '18. The program for each meeting is prepared by the officers assisted by the instructors in the department.

The program for the year 1916–17 follows:

October 6: "Early Reminiscences of the University of Oregon" by Edward H. McAlister, professor of mechanics and astronomy; "The History of Johns Hopkins University" by Roy M. Winger, professor of mathematics.
November 1: "The Fallacies of Arithmetic" by Lucile Watson '17; "The Construction, Theory, and Purpose of the Magic Square" by Loren Roberts '17.
December 6: "The Construction of Polygons by the Use of Ruler and Compasses" by Kenneth Moores '18; "The Problem of Squaring the Circle" by Ruth A. Westfall '18.

March 7: "Reminiscences of the Universities of Wisconsin, Chicago, and Yale" by Edgar E. De Cou, head of the department of mathematics; "Mathematical Recreations, Puzzles and Catch-problems" by Olga Soderstrom '18.
May 23: "The History of Correspondence Schools and the Progress of our University in this Regard" by Chester Kronenberg, instructor in mathematics; "The Application of Mathematics to Wave Surfaces" by Frederick E. Melzer '17.

The programs for the first two meetings of 1917–18 are as follows:

December 13: "The Problem of the Duplication of the Cube" by Elizabeth Carson '18; "Mathematics and the War" by Professor De Cou.
January 16: "The Problem of the Trisection of an Angle" by Cornelia Heess '18; "The Newton-Leibnitz Controversy over Calculus" by Edward E. Bentley '20.

THE MATHEMATICAL AND ASTRONOMICAL CLUB OF SWARTHMORE COLLEGE, Swarthmore, Pa.

This club was founded, in March, 1907, in order "to give students and faculty an opportunity to report upon subjects not usually treated in the classroom. It affords also an opportunity to bring to the students of mathematics from those outside the college two or more addresses which are given each year before the club; but the chief object is to develop in students the responsibility for certain exercises." Anyone desiring to become a member may do so. There are 42 members this year and the average attendance is about 30. No regular club dues are levied, but each year an assessment is made for current expenses; it never exceeds a dollar and is usually less than half that amount.

The following programs were given in the early part of 1917–18:

October 2: "Properties of Sound" by Harvey C. Hayes, professor of physics.
October 16: "Popular Phases of the Fourth Dimension" by Ethelwyn Bower '18.
November 6: "Determination of Latitude and Longitude by Means of Celestial Objects" by John Trimmer '18; "The Use of the Sextant" by Harry Yardley '19; "The Log Book of a Ship" by Ewing Carson '18.
November 20: "Opportunities open to Students of Mathematics" by John A. Miller, head of the department of mathematics and astronomy; "Plain Sailing," by Frank Fetter '20; "Mercator's Projection" by Robert Blau '18.
December 4: "Algol and its Use in the Determination of Light Wave-Lengths" by Dorothy Johnson '18; "History of the Parallax Problem" by Caroline Smedley Gr.; "Use of the Telescope and Galvanometer" by Hazel Brown Gr.; "Researches of Sproul Observatory" by Professors Miller, John H. Pitman (mathematics and astronomy), and Hayes.
December 18: "The Depression Range Finder and its Use in the Present War" by John Trimmer '18.

THE MATHEMATICS CLUB OF VASSAR COLLEGE, Poughkeepsie, N. Y.

This club was organized, in January, 1916, "to bring together students interested in mathematics, and to give them an opportunity to present papers themselves and to hear and discuss those presented by their fellow students. All students who have completed two semestral courses of elective[1] mathematics, and members of the faculty in the mathematics department are eligible for active membership. Students who have taken or are taking one course in elective mathematics, and members of the faculty in other than the mathematics department are eligible for associate membership." The club has 37 active members practically all of whom, and others, are present at each of the monthly meetings.

Officers, 1917–18: President, Beatrice Boyden '18; vice-president, Rachel G. Franklin '19; secretary-treasurer, Louise E. C. Stuerm '19; faculty member of executive committee, Professor Elizabeth B. Cowley; member at large on executive committee, Ruth De Land '18.

The following are programs for 1917–18:

October 30: "The Parallel Curves of the Conics" by Dr. Mary E. Wells.

November 13: "The Mathematics of Warfare" by J. Malcolm Bird, associate editor of *The Scientific American*.[2]

December 13: "The Slide Rule" by Helen Thompson '18; "Magic Squares" by Louise E. C. Stuerm '18.

January: "Planimeters" by Marjorie Wheatley '18; this paper was illustrated by planimeters made by the speaker's father, who is an engineer.

TOPICS FOR CLUB PROGRAMS.

6. WOMEN AS MATHEMATICIANS AND ASTRONOMERS.

The first woman mathematician regarding whom we have positive knowledge is the celebrated Hypatia,[3] recognized head of the Neoplatonic school, who was barbarously murdered at the hands of an Alexandrian mob in the early part of the fifth century. She was the daughter of Theon, also a mathematician and philosopher, who edited Euclid's *Elements*.[4] "Her great eloquence and rare modesty and beauty combined with her remarkable intellectual gifts attracted to her class-room a large number of pupils." She is said to have been the author of commentaries on works by Diophantus, Apollonius of Perga, and Ptolemy.

Maria Gaetana Agnesi, an Italian mathematician, linguist and philosopher of the eighteenth century was one of the twenty-three children of a rich and cultured gentleman of Milan who had a taste for science. "When only nine years old she had such command of Latin as to be able to publish an elaborate address in that language, maintaining that the pursuit of liberal studies was not improper for her sex. By the thirteenth year she had acquired Greek, Hebrew, French, Spanish, German and other languages. Two years later her father began to assemble in his house at stated intervals a circle of the most learned men in Bologna,[1] before whom she read and maintained a series of theses on the most abstruse philosophical questions" (*Encyclopædia Britannica*). Her father caused records of these meetings to be published when she was twenty years old. Then followed ten years of arduous labor, entered upon for the benefit of one of her brothers who had a taste for mathematics, and resulting in the publication of *Le Instituzioni Analitiche* (two quarto volumes, Milano, 1748). It is here (Vol. 1, pp. 380–81) that we find a discussion of the curve commonly known now as the "witch of Agnesi."[2]—French and English translations of this work were published in 1775 and 1801[3] respectively. In 1750 she was appointed professor of higher mathematics and natural philosophy[4] at the University of Bologna but never lectured. For the rest of her long life—she lived to be 81 years of age—she was occupied in charitable work and religious meditations. A younger sister was a well-known pianist and composer of three operas.

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[1] Vassar College requires a year of mathematics for freshmen.

[2] Mr. Bird's lecture was open to all members of the College and was attended by about 500 people, including practically all of the students of mathematics, and others. In *The Mathematics Teacher*, September, 1917, vol. 10, pp. 35–51, appeared an article on "The Mathematics of Warfare" by Mr. Byrd.

[3] See *Encyclopædia Britannica*, eleventh edition, 1910, article "Hypatia" with bibliography. Kingsley's romance will be recalled.

[4] *Cf.* HEATH, *The Thirteen Books of Euclid's Elements*, vol. 1, 1908, Chapter 5.

Among French representatives of women as mathematicians Sophie Germain (1776–1831) is the most notable. She was a pupil of Lagrange and a coworker with Biot, Legendre, Poisson and Lagrange. In 1816 the Institute of France awarded a prize for her memoir on the mathematical theory of the vibrations of elastic surfaces and its comparison with experience. This and other memoirs have been reviewed by Todhunter.[5] Her fame brought her into contact with such men as Ampère, Cauchy and Gauss.[6] Terquem has written an interesting biographical sketch.[7]

Russia produced Sonja Kovalevski (1850–1891) who studied mathematics for two years at the university of Heidelberg (under H. v. Helmholtz, Kirchhoff, Königsberger and du Bois-Reymond) and then proceeded to Berlin, where she prevailed upon Weierstrass to give her private lessons, since the doors of the university were closed to women. He soon found that she had "the gift of intuitive genius to a degree he had seldom found among men, even his older and more developed students." At the end of three years she presented to the university of Göttingen three theses worked out under the direction of Weierstrass through whose strong recommendation she was awarded the degree of doctor of philosophy without examination, and in absentia. Not long after this (1874) she returned to Russia. In 1883 she was appointed lecturer in mathematics at the university of Stockholm, and in 1884 full professor. This post she held till her death. Five of her memoirs were published in *Acta Mathematica* and the most notable is that of 1889, "Sur le problème de la rotation d'un corps solide autour d'un point fixe," which, in 1888, won the prix Bordin (doubled in value because of the remarkable merit of the memoir) of the Institute of France. Sonja Kovalevski "died just as she had attained the height of her fame and had won recognition even in her own country by election to membership of the St. Petersburg Academy of Science." [1]

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[1] Milan? Compare note 4.

[2] See F. G. TEIXEIRA, *Traité des courbes spéciales remarquables planes et gauches*, Coïmbre, 1908–9, Vol. 1, pp. 108–115, 385–6; Vol. 2, pp. 405–6.

[3] The review of this edition in the *Edinburgh Review* for January, 1804, is interesting.

[4] There is no basis in fact for the statements of the *Encyclopædia Britannica* to the effect that (1) Agnesi's father was professor in the University of Bologna or (2) her appointment as professor had anything to do with his illness. *Cf.* the best biography, L. ANZOLETTI, *Maria Gaetana Agnesi*, Milano, 1900, pp. 273ff. There is a sketch in *The Catholic Cyclopedia*, New York, Appleton, Vol. 1, 1907.

[5] *History of the Theory of Elasticity and of the Strength of Materials*, Vol. 1, Cambridge, 1886, pp. 147–160; see also CHASLES, *Rapport sur les progrès de la géométrie*, Paris, 1870, pp. 35–36; and H. STUPUY, *Œuvres philosophiques de Sophie Germain, suivies de pensées et de lettres inédites et précédées d'une étude sur sa vie et ses Œuvres*, Paris, Quantin, 1879; another edition, 1896.

[6] *Cf.* BONCOMPAGNI, *Lettera inedita di Carolo Fredrico Gauss a Sofia Germain*, Firenze, 1871; reviewed by C. Henry in *Bulletin des sciences mathématiques* (Darboux), Paris, tome 14, 1879, pp. 401–406.

[7] *Bulletin de bibliographie, d'histoire et de biographie mathématiques*, tome 6 (1860), pp. 9–12 (*Nouvelles Annales de mathématiques*, tome 19).

Of scientists in England a few notes may be given concerning the astronomer Caroline Herschel, who was born at Hanover, in 1750 and started her career in England, with her brother William, as teacher of music in Bath. When her brother accepted the office of astronomer to George III, she became his constant assistant in his observations and also executed laborious calculations which were connected with them. She discovered comets and remarkable nebulæ and completed the reduction to January, 1800, of 2,500 nebulæ discovered by her brother. The Royal Astronomical Society awarded her its gold medal and elected her an honorary member. She died at the age of 98, having spent about fifty years of her chief scientific activity in England.[2]

Perhaps the best single work containing biographies of scores of women mathematicians and astronomers is the second edition of A. REBIÈRE, *Les femmes dans la science*.[3] The bibliographies are full and valuable. Among portraits, it contains those of Agnesi, Sophie Germain, Caroline Herschel, Kovalevski, Agnes Mary Clarke, the English author of various works on the history of astronomy, Marquise du Châtelet[4] (pupil of Clairaut, Maupertius and Jean Bernoulli, and translator of Newton's *Principia*), Martha Mitchell, the astronomer of Vassar, Charlotte A. Scott, the mathematician at Bryn Mawr, Christine Ladd-Franklin of New York, and Dorothy Klumpe, a native of San Francisco, who is the only American who ever received the state doctorate in mathematical sciences in France.[1]

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[1] For sketches of Kovalevski's life reference may be given to A. C. LEFFLER, *Sonya Kovalevsky*, biography and autobiography, translated into English, London (1) Walter Scott, 1895, (2) T. Fisher Unwin, 1895; to the article in the eleventh edition of the *Encyclopædia Britannica*, 1911; to G. MITTAG-LEFFLER, "Sophie Kovalevsky, notice biographique," *Acta Mathematica*, Vol. 16 (portrait frontispiece), pp. 385–392, 1893; and to E. W. CARTER, "Sophie Kovalevsky," *Fortnightly Review*, Vol. 63, 1895, pp. 767–783. For other references see *Bibliotheca Mathematica*, 3. Reihe, Band 2, 1901, p. 337.

[2] For detailed biographical material see Mrs. John Herschel's *Memoir and Correspondence of Caroline Herschel*, 2d edition, London, Murray, 1879; *Dictionary of National Biography*, London, Vol. 26, 1891; and the Introduction to Volume I of *The Scientific Papers of Sir William Herschel*, London, Royal Society and Royal Astronomical Society, 1912.

[3] Paris, Novy, 1897, 361 pp.

[4] For other portraits see Carlyle's Works, centenary edition, New York, Scribner, 1908, Vol. 14, p. 191; and G. C. WILLIAMSON, *History of Portrait Miniatures*, London, Bell, 1904, Vol. 2, plate 87.

A more recent work by J. A. Zahm was published under the pseudonym H. J. Mozans with the title *Woman in Science with an introductory Chapter on Woman's long Struggle for Things of the Mind.*[2] While the book presents material of value for our topic it contains also many unreliable statements.

The highly interesting article by Gino Loria on "Les femmes mathématiciennes"[3] does not enter so much into details of the lives of the different women as into the consideration of the value of their contributions to science[4] in comparison with those made by many men. On the basis of available facts he finds himself obliged "with regret to make reservations in regard to those whom nature seems to have called to other destinies." Much the same conclusion is reached by the doctor, P. J. Möbius (grandson of A. J. Moebius) in his valuable *Ueber die Anlage zur Mathematik.*[5]

7. THE BINARY SCALE OF NOTATION, A RUSSIAN PEASANT METHOD OF MULTIPLICATION, THE GAME OF NIM AND CARDAN'S RINGS.

The binary system is built upon a scale of 2 instead of 10, thus using only two figures, 1 and 0. The succession of integers represented in the decimal notation by

$$1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10 \quad \cdots,$$

would appear in the binary system as follows:

$$1 \quad 10 \quad 11 \quad 100 \quad 101 \quad 110 \quad 111 \quad 1000 \quad 1001 \quad 1010 \quad \cdots.$$

By this means all addition is reduced to counting, all multiplication to simple additions, and division to simple subtractions. One inconvenience of the binary system is the large number of figures which may be required for a relatively small number. The binary representation requires for large numbers approximately 10/3 of the number of figures in the decimal representation. Legendre used binary numeration for calculating high powers and gave the following note[6] on a "very short method for expressing a somewhat large number in binary scale. Let the number be 11,183,445; . . . divide by 64, then the remainder is 21 and the quotient 174,741, which, divided by 64, gives the remainder 21 and the quotient 2730; finally 2730 divided by 64 gives the remainder 42 and the quotient 42; but 21 is expressed in binary numbers by 10101 and 42 by 101010. Then the proposed number is expressed by 101010 101010 010101 010101."

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[1] For a time, at least, Miss Klumpe was a member of the staff of the Paris Observatory.

[2] New York, Appleton, 1913. Chapter 3, pp. 136–166: "Women in Mathematics," chapter 4, pp. 167–196: "Women in Astronomy."

[3] *Revue scientifique*, Paris, Dumoulin, 1903, 4e série, tome 20, pp. 386–392. See also G. LORIA, "Donne matematiche," *Memoria letta il* 28 *dicembre*, 1901, *Atti e memorie della R. Accademia Virgiliana*, Mantova, 1903, pp. 75–98.

[4] In Note 1 of his Work ("Si la femme est capable de science," pages 287–319) Rebière considers this question. He quotes those holding opposing views, such as Molière, Prudhom, Schopenhauer, and Lalande, Stuart Mill, Anatole France.

[5] Leipzig, Barth, 1900. "Beiträge zur Kenntniss des Mathematischen Talentes. C. Ueber die mathematischen Weiber," pp. 77–86; portraits of Germain, Herschel and Kovalevski.

[6] A. M. LEGENDRE, *Essai sur la théorie des nombres*, Paris, 1798, p. 229; 2e édition, 1808, p. 209.

Fractions, decimals, subtraction, division, etc., in the binary system have been discussed by E. Collignon.[1] Reference may be given also to articles by C. Berdellé,[2] to the sketch by É. Lucas in *Récréations mathématiques*,[3] to an extract from the first lesson of Laplace at the *École Normale*, "le 1er pluviôse an III" [1795],[4] and to a note by E. Miot.[5]

Leibniz is often referred to as the founder of binary arithmetic. Whether this be true or not it is certain that the subject interested him considerably and that his publications[6] influenced, directly or indirectly, the production of a series of works such as those by T. F. De Lagny,[7] J. B. Wiedeburg,[8] F. S. Brunetti,[9] and G. F. Brander.[10] As early as 1698 Leibniz set forth the foundations of his binary arithmetic in a letter to Schulenburg and the matter occupied his attention for twenty years. His first published paper on the subject was in 1703. As its title indicates Leibniz believed that this arithmetic solved the mystery of a Chinese symbol Je-Kim (book of mutations) attributed to Fo-hy, the most ancient legislator in China. The symbol is composed of 64 figures each formed of six horizontal lines (some whole, others broken in the middle)one above the other.[11] Interpreting each whole line as corresponding to 1 and each broken line to 0, Leibniz translated the figures as corresponding to 0, 1, 2, $\cdots$, 63. But such an interpretation has been shown to be worthless.[12] In honor of Leibniz's discoveries in connection with binary arithmetic a medal was struck by Rudolph August, duke of Braunschweig. A copy of this medal forms the frontispiece to Wiedeburg's dissertation and is also given on p. 1002 of *Collectanea de Breslau.*

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[1] "Note sur l'arithmétique binaire," *Journal de mathématiques élémentaires* (De Longchamps), 1897, tome 21, pp. 101–106, 126–131, 148–151, 171–174.

[2] *Association française pour l'avancement des sciences:* (*a*) "La numération binaire et la numération octovale," 1887; (*b*) "Arithmétique de la gamme," 1897; (*c*) "Les curiosités du calcul," 1898. Also *L'Intermédiaire des mathématiciens*, 1904, tome 11, pp. 269–271.

[3] 2e édition, Paris, Gauthier-Villars, 1891, pp. 143–160.

[4] *L'Education mathématique*, 7e année, 1904, pp. 59–60.

[5] *L'Intermédiaire des mathématiciens*, 1911, tome 18, p. 190.

[6] (*a*) "Explication de l'arithmétique binaire, qui se sert des seuls caractères 0 et 1: avec des remarques sur son utilité et sur ce qu'elle donne le sens des anciennes figures Chinoises de Fohy," *Histoire de l'académie des sciences de Paris*, 1703, pp. 58–63; *Mémoires*, pp. 85–89. Also, *Opera omnia*, Genevæ, vol. 3, 1768, pp. 390–394. (*b*) "De inventione arithmeticæ binariæ a G. G. Leibnitio. Excerpta ex vitâ Leibnitii a D. Jancourt scripta," *Opera omnia*, vol. 3, pp. 346–348. (*c*) "G. G. Leibnitii epistolæ duæ ad J. C. Schulenburgium, De Arithmeticâ Dyadicâ . . .," *Opera omnia*, vol. 3, pp. 349–354.

[7] *L'arithmétique nouvelle*, Rochefort, 1703. (Hutton states that De Lagny proposed a new system of logarithms, on the plan of binary arithmetic, which he found shorter and more easy and natural than the common ones.)

[8] *Dissertatio mathematica de praestantia arithmeticæ binariæ prædecimali* . . ., Jenae, 1718.

[9] *Arithmetica binomica e diadica, in cui tutte le operazioni si fanno colle sole figure Uno, e Zero* (Riflessione al Giornale de'Letterati di Roma an 1746, page 884). Roma, 1746; another edition, 1754.

[10] *Arithmetica binaria sive dyadica, das ist, Die Kunst nur mit zwey Zahlen in allen vorkommenden Fällen sicher und leicht zu rechnen*, Augsburg, 1769; another edition, 1775.

[11] *Cf.* P. CARUS, "Chinese Philosophy," *The Monist*, Chicago, 1896, vol. 6, especially pages 191 ff.

[12] *Annales du musée guimet*, tome 8 (1885) and 23 (1893).

The problem of calculating π in the binary system, proposed several times by Leibniz (*Opera omnia,* tome 3, pp. 521, 547· · ·), was solved by Jacob Bernoulli.[1] For log π in binary system see *Journal de Mathématiques élémentaires* (Bourget), Paris, tome 2, 1878, p. 229.

Peano has indicated applications of the binary system in "La numerazione binaria applicata alla stenografia," *Atti della R. Accademia delle Scienze di Torino,* 1898; (*b*) *Formulaire de Mathématiques,* 1901, pp. 77, 154, 177.

The source of the many references to a Russian peasant method of multiplication seems to have been the publication in 1896 by G. De Longchamps of a request from a Mr. Plackowo (of Tokarewka in the government of Tamboff, Russia) for an explanation of the method. An example will suffice to illustrate both the method and the connection with the binary system of numeration. Suppose, for example, the problem is to multiply 35 by 42. Divide one of the numbers (say 35) by 2, giving 17 (remainder neglected) and multiply 42 by 2; continuing the process we get the following series of corresponding numbers:

35	17	8	4	2	1
42	84	168	336	672	1344.

Add the numbers of the second row corresponding to odd numbers in the first row and we obtain the required product 1470. In *Mathematical Gazette,* 1917, Vol. 9, p. 9, G. H. Bryan has a note on "'Russian Peasant' Multiplication in Roman Numerals." References may be given also to: J. Bowen, "The Russian Peasant Method of Multiplication," *The Mathematics Teacher,* 1912, Vol. 5, pp. 4–8; E. Czuber, "Ueber ein Multiplikationsverfahren," *Zeitschrift für das Realschulwesen,* Dezember, 1915.

The application of the binary scale of notation to "Nim, a Game with a complete Mathematical Theory" was explained by C. L. Bouton in *Annals of Mathematics,* 1901, 2d series, Vol. 3, pp. 35–39. To him is due also the name which was chosen in preference to Fan-tan, which had been used, because it is not the same as the Chinese game of that name. "The game is played by two players. Upon the table are placed three piles of objects of any kind, let us say counters. The number in each pile is quite arbitrary, except that it is well to agree that no piles shall be equal at the beginning. A play is made as follows: The player selects one of the piles, and from it takes as many counters as he chooses; one, two, . . ., or the whole pile. The only essential things about a play are that the counters shall be taken from a single pile, and that at least one shall be taken. The players play alternately, and the player who takes up the last counter or counters from the table wins." See also E. H. Moore, "A Generalization of the Game called Nim," *Annals of Mathematics,* 1910, 2d series, Vol. 11, pp. 93–4.

The toy usually known as "Chinese Rings"[2] seems to have been first described by CARDAN on page 294 of his *De Subtilitate*, Nuremberg, 1550. It is also discussed by John Wallis in the Latin edition of his *Algebra*, 1693 (*Opera*, Vol. 2, pp. 472–478). The toy "consists of a number of rings hung upon a bar in such a manner that the ring at one end (say A) can be taken off or put on the bar at pleasure; but any other ring can be taken off or put on only when the one next to it towards A is on, and all the rest towards A are off the bar. The order of the rings cannot be changed." A pretty full discussion of the number of operations required to remove the rings from the bar (a problem which Cardan and Wallis failed to solve) has been given in W. W. R. BALL, *Mathematical Recreations and Essays*, 5th ed., London, Macmillan, 1911, pp. 230–234. Practically all that is in Ball's sketch, and considerable more, is given in E. LUCAS, *Récréations Mathématiques*, Paris, Gauthier-Villars, tome 1, 2e éd., 1891, pp. 161–186. The discussion of the number of operations by means of the binary scale is due to [L. GROS], *Théorie du Baguenodier*, par un clerc de notaire lyonnais, Lyon, 1872.

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[1] *Cf.* Leibniz, *Math. Schriften* (Gehrhardt), vol. 3, p. 97.

[2] In French: baguenaudier.

NOTES AND NEWS.

Professor E. W. BROWN, of Yale University, was elected a member of the Council of the American Philosophical Society at the January meeting.

The Paris Academy of Science during the year 1917 awarded seventy-seven prizes for especial achievements in science, eight of which were granted to mathematicians.

The Royal Society held its regular meeting on December 6, 1917, under the presidency of Sir J. J. THOMPSON. The only mathematical papers presented were "The series of Legendre," by W. H. YOUNG, and "The Zeros of Bessel functions," by G. N. WATSON. The London Mathematical Society held its monthly meeting on the same date, with vice-president H. HILTON presiding. The following papers were presented: "A new method of describing three-bar curves," by R. L. HIPPISLEY; "Proof of the primality of $N = (10^{19} - 1)/9$," by O. HOPPE; "New Tauberian theorems," by HARDY and LITTLEWOOD; "The curves which lie on the quartic surface in space of four dimensions," by C. V. H. RAO; "The connection between Legendre series and Fourier series," and "Series of Bessel functions," by W. H. YOUNG.

The third volume of the *Proceedings* of the National Academy of Sciences of the United States of America has been completed. The membership of the Academy now numbers one hundred fifty-eight, distributed somewhat irregularly over the United States, and representing the fields of mathematical, physical and biological sciences. Twelve members of the Academy are now, or have been, professors of mathematics. The table of contents of papers presented shows thirteen titles belonging to the field of mathematics, only two of which were credited to members of the Academy. The roster also shows twenty-six foreign associate members, four of whom are noted mathematicians, two belonging to the central, and two to the allied powers.